Fischer-Tropsch Diesel Fuels Proposed Rules
(With Army TACOM/TARDEC/NAC Input to Questions)
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Submitted by:

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In response to questions in:

> **DEPARTMENT OF ENERGY, Office of Energy Efficiency and Renewable Energy, 10 CFR Part 490, [Docket No. EE–RM–02–200], Alternative Fuel Transportation Program; Fischer-Tropsch Diesel Fuels Proposed Rules, Federal Register,** Vol. 67, No. 175, Tuesday, September 10, 2002

DOE Questions:

1. How should DOE define natural gas-based diesel fuels, and particularly FTD fuels, if designation is ultimately limited to that process?

NAC: Since FTD is not yet available in CONUS from CONUS natural gas, we believe that FTD from natural gas should not be restricted to CONUS natural gas and should include all sources of natural gas. This will help facilitate demonstration of FTD as a viable transportation fuel for use in diesel engines and reformers for fuel cells.

It may also help development of jet fuel specifications that can allow use of synthetic fuel componebts.

2. DOE requests comments on analysis provided by the Argonne National Laboratory (ANL) and the National Renewable Energy Laboratory (NREL), which will be used for making a determination regarding designation of FTD fuels. DOE also requests that interested parties submit any additional emissions data not cited in the NREL report.

NAC: FTD was included in a Army project that compared exhaust emissions from a modern diesel powered Class 8 tractor truck in a program that is electrifying engine components using fuel cell electricity. Reductions of emissions were significant compared to EPA certification diesel No 2. Attached abridgement of the report is submitted with permission of SunLine Services Company and Southwest Research Institute (Mr. Alan Montemayor). The citation or cover page for the report includes:

> PHASED INTRODUCTION OF FUEL CELLS INTO A CLASS 8 TRACTOR, INTERIM REPORT, SwRI Project No. 03983, Prime Contract No. DAAE07-98-3-0025, Prepared For SunLine Services Group, 32-505 Harry Oliver Trail, Thousand Palms, CA 92276-3501; Prepared By Joe Redfield, Group Leader, Alan F. Montemayor, Principal Engineer, Mark Walls, Senior Designer, Leo Stavinoha,

Consultant VMS, Greg Ostrowski, Research Engineer, James Jarvinen, Engineering Technician; Southwest Research Institute, 6220 Culebra Road, San Antonio, TX 78238-5166; May 22, 2002

3. Should DOE set process energy use limits in its EPAct designation process to ensure that qualifying FTD fuels provide substantial energy security benefits? If so, which levels are appropriate?

NAC: Probably yes, but the actual process energy use allowed could be very liberal so that FTD would be available for use.

4. How should DOE balance its determinations about designating fuels if the fuels provide substantial benefits in some areas with regard to section 301(2) criteria, while being a slight detriment to others *(e.g.*, positive attributes regarding criteria pollutants versus a slight increase in greenhouse gas emissions)? Is such an approach desirable?

NAC: Energy security is prime as FTD replaces import of petroleum crude derived diesel fuel. This could open up large sources of liquid fuel from natural gas in remote sites.

5. DOE requests comments on findings in NREL's report about NOX emissions benefits of 6–20 percent (compared to post-2006 diesel fuels) related to control of fuel aromatic content and cetane number. Should these benefits be considered ''substantial'' with regard to section 301(2) criteria?

NAC: Ultra low sulfur diesel fuel post 2006 diesel fuels will facilitate engine exhaust gas emission reduction devices but may not actually reduce controlled emissions. Low aromatic-high cetane diesel fuel will help reduce emissions from older diesel engines. Literature data suggests that modern diesel engines will not respond significantly to high cetane number in reducing NOx. Reduced aromatics may also reduce PM from older engines.

6. DOE is seeking additional data on actual test and control fuels for FTD when used in later-model diesel engines to gauge how fuel composition affects emissions from these engines.

NAC: See response to Question No. 2 for additional data for a 2001 vintage engine.

7. What parameters should be set for aromatics, cetane, sulfur, and other standards to assure emissions reductions based on NREL's findings or other sources of information? Also, will FTD fuels in the lower end of the aromatics range result in materials compatibility problems and should polyaromatic content be included in addition to, or in lieu of, a limit on total aromatics? Should paraffin content be used to assure emissions reductions, and if so, do both normal- and iso-paraffin content need to be specified?

NAC: While a variety of limits for FTD could be advantageous, a low aromatic specification is suggested as follows:

Aromatics; <1 percent
Cetane number; >60
Sulfur; <1 ppm
Density; > 0.76 g/mL

Most likely, the fuels should also meet ASTM D975 diesel fuel specification property limits for the most part.

For reduced emissions, total aromatics should be limited to < 10 percent (or preferably less than 1 percent) and no measurable poly aromatics should be allowed.

Switch loading between very low and regular aromatic fuels in older engines is expected to result in some injector pump problems, and is considered to be a potentia l problem in Army diesel equipment. Provisioning for these problematic engines will be facilitated by RDT&E.

Cold temperature properties should determine how much normal paraffins should be allowed. Cloud point is usually used to control cold weather properties.

8. There are various ways DOE might designate fuels with relation to greenhouse gas (GHG) emissions. The discussion paper located at the website address listed above suggests three such ways to view this question. DOE requests comments on which option would be most appropriate, and what levels of GHG emissions should be set if a particular option is chosen.

NAC: If applied, it would seem the limit could equal that of petroleum crude derived diesel fuel.

9. DOE seeks any information and data collected about toxicity issues and ecotoxicity/biodegradability issues related to FTD.

NAC: While the literature suggests that FTD containing predominately paraffins is biodegradable by somewhat accepted methods of measurement, the significance of this measure in ecosystems is in need of further discussion. This should not impact FTD acceptance as an alternative fuel to petroleum crude diesel.

10. DOE requests comments on limiting oxygenated compounds in FTD fuels or suggestions on alternative approaches. Possibilities are outlined in the discussion paper.

NAC: While oxygenates may not present a problem, it may be wise to limit to 0.25 percent oxygen? The oxygen in biodiesel in B20 has not been considered a problem. FTD evaluated to date in our laboratories has not contained measurable oxygenates. Flash point probably should not be below that in ASTM D975 diesel fuel specification.

11. Are any of FTD fuels' characteristics sufficiently unique to justify inclusion of specific additives to assure that inherent environmental benefits are not degraded or negated due to negative impacts on engine components or emission control systems?

NAC: In general, engine components are sensitive to fuel lubricity (related to fuel wetted component wear of rubbing components) and elastomer failure due to swell/shrinkage related fuel solvency (primarily aromaticity). The ASTM D 975 diesel fuel specification should be used to control these properties. Preference of fuel cell reformer for minimal aromatics may be overcome as technology is developed. Lubricity additives may need to be neutral as opposed to acidic for some engine fuel pump designs.

12. Are there other issues that DOE should consider related to Fischer-Tropsch diesel fuel production and use relative to its possible designation as an alternative fuel?

NAC: If most of the low cost natural gas is non domestic, FTD from nondomestic natural gas should be used as an alternative to petroleum crude diesel fuel for energy security enhancement and sulfur emissions reduction.